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ABSTRACT

The causal structure between academic achievement and cognitive, psychological, and facilitative variables during the freshman year in college was studied. Data from 455 freshmen were used in the analysis. Participants completed measures of student goals, facilitative skills, and learning and thinking styles. Pre-college and freshman achievement were determined, and academic motivation, locus of control, study skills, concentration, and self-efficacy were generated from the administered measures. Structural equation modeling procedures were used to identify theoretical relations and to test the plausibility of a causal framework. Results reveal a nonlinear relationship between psychological variables such as academic motivation, locus of control, and self-efficacy, and freshman academic achievement. Being academically motivated, preferring internal attributions for academic outcomes, and having confidence in one's ability to do well in college do not directly result in good academic performance in the freshman year. Findings imply that other factors, such as adequate academic preparation, adjustment to instructional styles and the college environment, and the ability to prioritize study are necessary to help freshmen cope with academic challenges in the freshman year. (Contains 3 tables, 2 figures, and 38 references.) (SLD)

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Freshman Academic Achievement: A Structural Equation Model

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Freshman Academic Achievement: A Structural Equation Model

The freshman year marks an important transition period from secondary schooling to college education. In addition to coping with identity issues in a broader context of social integration, freshmen also face the challenge of meeting academic requirements in a learning environment characterized by instructional styles and expectations drastically different from those of high school (Lindgren, 1969). What are the factors that affect freshman achievement? How can educators better prepare entering students for this transition period? The present study seeks to address these questions. Specifically, it attempts to investigate the causal structure between academic achievement and cognitive, psychological, and facilitative variables during the freshman year.

Literature Review

In their search for a better understanding of freshman academic achievement, researchers and educators have examined a variety of factors. Although each study represents a unique focus, the body of literature as a whole points to the influence of cognitive and psychological factors as well as facilitative skills on freshman academic achievement. These studies provide a theoretical framework for the present investigation.

Cognitive Variables and Freshman Achievement

Due to the temporal proximity between secondary schooling and college education, high school performance indicators such as grade point average (GPA), grades, high school rank, and SAT scores have been used as cognitive predictors of freshman academic achievement (Ferrari & Parker, 1992; Talbot, 1990). Ferrari and Parker's study with 319 college freshmen revealed a significant positive correlation between Fall GPA and high school English average and between Fall credits completed and high school math and English average, and average SAT math and verbal scores. High-school achievement, together with preferences for a complex explanation of behavior, was found to correlate best with college achievement and persistence (Talbot, 1990).

Minnaert and Janssen (1992) explored another dimension of the relationship between cognitive variables and college achievement when they operationalized cognitive variables as curriculum completed in secondary education, prior knowledge, and reading speed and accuracy

in a study with 161 Belgian freshmen. Using a structural equation model that included a motivational variable and a study-skills variable, Minnaert and Janssen demonstrated that, except for speed of information processing, all the cognitive variables had a substantial influence on success and progress in higher education.

Psychological Variables and Freshman Achievement

Numerous studies have shown that the academic achievement of college students in general and college freshmen in particular is affected not only by precollege achievement, but also by a variety of psychological factors. Among these factors are self-efficacy, locus of control, and motivation.

Self-efficacy refers to people's judgments of their capacities to organize and execute courses of action required to attain designated types of performances (Bandura, 1989). Self-efficacy beliefs operate on human action through motivational, cognitive, and affective intervening processes. People with a stronger sense of efficacy set higher goals for themselves, exert more efforts to work towards their goals, and are more likely to persevere in the face of difficulty. Self-efficacy is developed through feedback from past performance and vicarious learning experiences.

Self-efficacy may be task-specific or global. Task-specific self-efficacy can better predict personal goals and performance than can more global measures such as self-esteem (Bandura, 1986). For example, grade self-efficacy was proved to be a more valid predictor of both grade goals and exam performance than general academic self-efficacy (Mone, 1995). Ferrari and Parker's (1992) study with college freshmen reported that general efficacy was not significantly related to Fall GPA and credits completed.

Locus of control is another psychological construct often studied in conjunction with academic achievement. Rooted in social learning theory, Rotter's (1966) idea of locus of control captures the distinction between self-determination and control by others. The underlying assumption of the theory is that learning and performance in specific situations are different when people perceive that they control, or lack control over the contingency between behavior and reinforcement (Phares, 1976). Since achievement is defined in terms of achievement behavior (e.g., grades in school), achievement need (e.g., desire to attain excellence, need to surpass

others), and an expectancy component of achievement (subjective probability held by the individual that achievement behaviors will lead to the attainment of achievement-related goals) (Rotter, 1960), the effects of locus of control on achievement should be examined accordingly.

Research findings on the relations between locus of control and achievement behavior have not been conclusive. Lessing (1969) found internality in junior and senior high-school students to be related to GPA when IQ was controlled. The correlation between cumulative GPA and internality was significant (.47) for male college seniors but not for female (.16) (Brown & Strickland, 1972). As for college freshmen, negligible correlations were found between locus of control and freshman grades (Warehime, 1972). More recent studies have shown that internal students in high school achieved at a higher level (Keith, Pottebaum, & Eberhart, 1986), that a moderate relationship existed between locus of control and performance on the National Board of Medical Examiners for black medical students (Webb, Waugh, & Herbert, 1993), and that there were negative relationships between locus of control and academic achievement for black at-risk students (Howerton, Enger, & Cobbs, 1993).

Motivation is another psychological factor that has an impact on school achievement. As an internal process, motivation activates, guides, and maintains behavior over time (Baron, 1992; Schunk, 1990). When understood in terms of goals, motivation may be intrinsic (learning goals) or extrinsic (performance goals). Students who set learning goals tend to seek challenges and persist when they encounter difficulties whereas students who set performance goals are more concerned about how they might be judged by others, and they are likely to give up in the face of difficulty to avoid seeming incompetent (Nicholls & Miller, 1984).

In an effort to identify strategies used by successful (grades = B or above) and unsuccessful students (grades = C or below), Lindgren (1969) interviewed 40 college students. While the successful students attributed their success mainly to "good study habits" and "interest," those with a grade of C or below mentioned "lack of study" and "lack of interest" as the two main reasons for their unsatisfactory performance. These findings imply that motivation is as important as study methods in contributing to success in college (Lindgren, 1969).

Facilitative Skills and Academic Achievement

Facilitative skills in an academic context refer to strategies and approaches an

individual may employ to maximize learning outcomes. According to the information-processing theory, learning strategies such as focusing on relevant stimuli (Maccoby & Hagen, 1965), coding information in both verbal and imagery systems (Paivio, 1971), relating new information to a previous knowledge base (Stein & Bransford, 1979), and organizing internal knowledge as well as study materials (Bower, Clark, Lesgold, & Winzenz, 1969) may help students better process, store, and retrieve information. Facilitative skills also entail managing time, controlling test anxiety, and focusing on tasks undertaken. These skills enable college students to effectively handle course requirements while maintaining active participation in different aspects of the college experience.

Research findings on the correlation between study skills and academic achievement as measured by GPA were relatively consistent: .52 as reported by Gadzella and Williamson (1984) based on a study with 110 undergraduate psychology majors and .48 as reported by Gadzella, Ginther, and Williamson (1987) based on a study of 132 college students of the same major. Time management skills were also found to be related to academic achievement. While the use of "strict" scheduling was the same by both successful students (grade = B or above) and unsuccessful students (grade = C or below), more students in the former category reported using "loose and flexible" scheduling (Lindgren, 1969). Recent research on learning styles revealed that distractibility, a deficiency in cognitive styles, distinguished students with differing achievement levels. Students with higher GPAs possessed a stronger ability to stay on tasks than students with lower GPAs (Zhang & RiCharde, 1997). Taken together, these research findings suggest that study skills, time management, and the ability to concentrate on tasks facilitate learning and academic achievement.

In sum, research is abundant on the relationship between academic achievement on the one hand and cognitive, psychological, and facilitative variables on the other. Little has been done, however, to investigate the causal relations between academic achievement and cognitive, psychological, and facilitative variables, especially within the context of the freshman year. The present study is intended to help fill this gap. Specifically, the study attempts to determine the causal structures between cognitive, psychological, and facilitative variables as well as the causal structures between these variables and freshman achievement in a structural equation model.

Method

Sample

Data from 455 college freshmen were used in the analysis. After multiple files were merged, the valid sample size was reduced to 355. Ninety-five percent of the students were male and the ethic makeup was 81% White, 7.6% Black, 5.4% Asian, and 2.5% Hispanics. Approximately 32% of the participants majored in engineering, 15 % in science, and 53% in the liberal arts. The average age of the sample was 19 at the time of matriculation.

Measures

Immediately following matriculation, students were measured on several instruments including the Entering-Student Goal Inventory (ESGI) (RiCharde, 1992), the College Facilitative Skills Inventory (CFSI) (Zhang & RiCharde, 1997), and the Learning-Thinking Styles Inventory (LTSI) (RiCharde, 1992). Precollege cognitive variables and information on academic achievement during the freshman year were obtained from the institutional database.

Precollge Achievement. Precollege Achievement was measured by three indicators: high school GPA (HSGPA), SAT composite score (SAT), and entering algebra test score (Math). The algebra test is a 32-item placement test with an alpha reliability of .74. Since the performance on the algebra test is a reflection of entering students' mastery of math concepts prior to college, the test was justified as an indicator of precollege achievement.

Academic Motivation. As a composite variable, Academic Motivation was generated out of four items from the ESGI, a 52-item instrument surveying students' reasons for attending college and the goals they expect to attain as a result of the college experience. Cronbach alpha reliability of the instrument is .86. Of the four items used to form the variable of Academic Motivation, two pertain to critical thinking skills and intellectual development, one to effective communication skills, and one is about plans to attend graduate school for further education. The alpha reliability of Academic Motivation was .68.

Self-Efficacy. Self-Efficacy is a composite variable generated out of the CFSI. The variable was based on four items measuring one's confidence in performing well on a test, learning new tasks, grasping new ideas of a lecture, and having adequate study skills. The analysis of the data yielded an alpha reliability of .60 for Self-Efficacy.

Internal Locus of Control. Internal Locus of Control is a composite variable from the CFSI. The variable was derived from students' responses to eleven items that measure their attributional tendency for academic and social events. Following Rotter's model (1966), each item provides bipolar options where an academic outcome (e.g., failing a test) may be attributed to internal causes (did not study enough) or external ones (the teacher was not fair). Since a higher score on the construct is designed to represent a tendency for internal attribution, this variable is labeled Internal Locus of Control. The internal consistency of the variable was evidenced in its alpha reliability of .70.

Study Skills. Study Skills is one of the six constructs measured by the CFSI, a 51-item instrument surveying general preparedness and facilitative skills of college freshmen. The alpha reliability of the instrument is .85. Study Skills was extrapolated from seven items measuring basic study strategies such as connecting related concepts and ideas in understanding a lecture, organizing notes after class, and adjusting study methods to solve problems. The alpha reliability of Study Skills was .72.

Concentration. Concentration is generated out of distractibility, one of the four dimensions measured by the 49-item LTSI; the other three are perceptual modality, metacognition, and analytic versus global tendency. The LTSI was developed within the framework of the information-processing and trait theories. The construct validity of the instrument was evidenced in the congruence between its four dimensions and LISREL-confirmed four factors (Zhang & RiCharde, 1997). Alpha reliabilities were .60, .46, .68, and .64 for perceptual modality, distractibility, metacognition, and analytic versus global tendency. In the present study, since reversed scoring was used for the nine items measuring distractibility, the composite variable was labeled Concentration. Students scoring high on this variable can easily focus their attention on academic tasks such as listening to a lecture, doing homework assignments, or taking a test. The alpha reliability for Concentration was .36.

Freshman Achievement. In this study Freshman Achievement was comprised of two measures: Fall cumulative GPA (CGPA1) and Spring cumulative GPA (CGPA2).

Data Analysis

Structural equation modeling procedures based on the analysis of covariance structures were used to identify potentially important theoretical relations, and to test the plausibility of the causal framework comprising cognitive, psychological, and facilitative variables and freshman achievement as measured by college GPAs. The methodology involved a confirmatory approach in which an a priori postulation of a model structure was tested and substantiated by theory and empirical research.

Two steps were taken before data analysis. First, scoring was reversed on items measuring distractibility and locus of control so that high scores indicated ability to concentrate on academic tasks (Concentration) and tendency for internal attribution (Internal Locus of Control). Second, items were combined to form measurement indicators for each construct. Based on similarity of item content and difference in item means (Gorsuch, 1983), two to four items were combined to form a measurement indicator, resulting in two indicators for Academic Motivation (AM1 and AM2), two for Self-Efficacy (SE1 and SE2), three for Internal Locus of Control (ILOC1, ILOC2, and ILOC3), three for Study Skills (SS1, SS2, and SS3), and three for Concentration (C1, C2, and C3). HSGPA, SAT, and Math remained separate measurement indicators for Precollege Achievement whereas CGPA1 and CGPA2 functioned as two indicators for Freshman Achievement. Multiple measurement indicators were used for each construct in order to maximize the advantages of the structural equation model (Marsh, 1990).

The test of the full model was conducted using LISREL 8 (Jöreskog & Sörbom, 1993). First, confirmatory factor analysis was conducted on the data to validate the adequacy of the measurement model. Once the measurement model was established, the focus of investigation was then placed on the structural equation model where the postulated relations between latent variables were assessed for goodness-of-fit. Given evidence of inadequate fit, the model was respecified to include additional causal paths suggested by the modification indices of the LISREL printout and on the basis of substantive theory and statistical significance (Byrne, 1998). Finally, once the best-fitting model was obtained, nonsignificant parameters were deleted on the basis of trivial contribution to illuminating the causal relations of the model.

Multiple criteria were considered for assessment of the model fit. As such, they reflect statistical, theoretical, and practical considerations (Byrne, 1998). The assessment criteria include (a) the χ^2 likelihood ratio with smaller values indicating better fit between the sample covariance and fitted covariance matrices (Jöreskog & Sörbom, 1993), (b) the χ^2/degree of freedom (χ^2/df) ratio, an index indicating the relative efficiency of alternative models in accounting for the data, with values of 2.00 or less interpreted as indicating adequate fit, (c) the Comparative Fit Index (CFI), a statistic derived from the comparison of a hypothesized model with the independent model; the statistic ranges from zero to1.00 with a value > .90 indicating an acceptable fit to the data (Bentler, 1992), (d) the Expected Cross-Validation Index (ECVI) that measures the discrepancy between the fitted covariance matrix in the analyzed sample and that of another sample of equivalent size; the model having the smallest ECVI value exhibits the greatest potential for replication (Byrne, 1998), (e) the Root Mean Square Error of Approximation (RMSEA) which takes into account the error of approximation in the population, with values < .05 being indicative of good fit (Browne & Cudeck, 1993), and (f) the substantative meaningfulness of the model (MacCallum, 1986).

Hypothesized Model

The model was composed of seven latent variables: three psychological (Academic Motivation, Self-Efficacy, and Internal Locus of Control), two facilitative (Study Skills and Concentration), and two cognitive (Precollege Achievement and Freshman Achievement). Academic Motivation, Internal Locus of Control, Concentration, and Precollege Achievement were treated as exogenous latent variables whereas Self-Efficacy, Study Skills, and Freshman Achievement as endogenous latent variables. Based on the theoretical framework that emerged from the literature and preliminary analysis of the data, it was hypothesized that (1) Concentration and Precollege Achievement have a positive influence on Self-Efficacy which, in turn, has a positive impact on Freshman Achievement, (2) Concentration, Academic Motivation, and Internal Locus of Control have a positive influence on Study Skills which, in turn, has a positive impact on Freshman Achievement, and (3) Concentration and Precollege Achievement have a positive influence on Freshman Achievement. The hypothesized model is presented in Figure 1.

[Insert Figure 1 About Here]

Results

Statistical Analysis of the Measurement Model

Preliminary analysis of the 18 measurement indicators revealed that 83% of the univariate skewnesses were less than 1 and none exceeded 1.6 in absolute value; 77% of the kurtoses were less than 1 and only three were greater than 2 in absolute value. Since most univariate skewnesses and kurtoses did not exceed $\pm$ 1, the method of Maximum Likelihood (ML) was used for paremeter estimation (Muthen & Kaplan, 1985).

Table 1 reports the loadings of the measurement indicators on their postulated constructs. Error variance of the indicators from the Theta-Delta matrix is also included in the table. All measurement indicators demonstrated statistically significant and strong loadings (.46 to .93) on their target constructs. Only one crossloading was allowed in the estimation process to improve data-to-model fit. The adequacy of the measurement model was evidenced in all satisfactory model-fitting indices (χ^2/df = 1.70, CFI = .96, ECVI = .87 as opposed to .97 in the saturated model and 5.55 for the independent model, RMSEA = .045). These statistics lend support to the conclusion that the indicators did an excellent job of measuring the latent variables included in the model and consequently established a sound measurement foundation for the exploration of the causal relations to be conducted in the next section.

[Insert Table 1 About Here]

Statistical Analysis of the Structural Equation Model

The results of the model-fitting procedures are summarized in Table 2. The hypothesized model yielded a marginal fit to the data (CFI = .90, and RMSEA = .06). Modification indices suggested that relaxation of certain constraints would lead to a significantly better fitting model. Thus, the original model was respecified to (a) include crossloadings of measurement indicators, (b) relax constraints on covariance of some latent exogenous variables, and (c) modify the causal paths between exogenous and endogenous variables.

In order to evaluate the extent to which the newly specified model exhibits an improvement in fit over its predecessor, we recorded the difference in χ^2 ($\Delta\chi^2$) between the two models. This differential is χ^2-distributed with degrees of freedom equal to the difference in

degrees of freedom (Δdf) and can be tested statistically. A significant $\Delta\chi^2$ indicates a substantial improvement in data-to-model fit (Byrne, 1991).

[Insert Table 2 About Here]

Table 2 summarizes the changes in test statistics for the initial and respecified models. It can be seen that including crossloadings for Self-Efficacy on Study Skills, for Study Skills on Freshman Achievement, for Internal Locus of Control on Concentration, and for Internal Locus of Control on Precollege Achievement resulted in a significantly improved ($\Delta\chi^2_{(3)} = 61.19$, $p < .001$) and well-fitting model (CFI = .93, RMSEA = .05). Still better results were obtained both in statistical significance ($\Delta\chi^2_{(2)} = 52.55$, $p < .001$) and model-fitting indices (CFI = .96, RMSEA = .04) when the constraints on covariance between Concentration and Precollege Achievement, between Concentration and Internal Locus of Control, and between SAT and Study Skills were relaxed. The reparameterization in Model 4 involved the removal of one path, GA (2,1; Concentration–>Study Skills), whose negative regression coefficient was neither significant statistically nor substantiated theoretically. This final modification led to a simplified causal structure with minimal change in fit statistics. The final model of the causal structure of freshman achievement is presented in Figure 2.

[Insert Figure 2 About Here]

The squared multiple correlations for the structural equations were relatively high: 63%, 70%, and 53% for Self-Efficacy, Study Skills, and Freshman Achievement, respectively. These statistics demonstrated the strength of latent variables in measuring the endogenous variables. The standardized effect parameters, indicating the relative influence of a variable in the model, are discussed below within the context of the three hypotheses (see Table 3).

Hypothesis 1. The first structural equation in the model examined the influence of Concentration and Precollege Achievement on Self-Efficacy, as well as the subsequent influence of Self-Efficacy on Freshman Achievement. As hypothesized, both Concentration (.72) and Precollege Achievement (.17) were found to have a significantly positive influence on Self-Efficacy. Contrary to our expectations, however, Self-Efficacy exerted a significantly negative impact (-.23) on Freshman Achievement. Revealed from these findings was the dynamic nature of self-efficacy. As a psychological construct, self-efficacy is positively influenced by previous

academic achievement and by one's ability to concentrate on tasks, yet it may not be predictive of Freshman Achievement. One possible reason for this is because self-efficacy as measured in the present study was global rather than grade-specific (Ferrari & Parker, 1992). In other words, students' confidence in their ability to manage academic tasks and perform well in college may not be predictive of their college GPA since the former is global whereas the latter is very specific. The finding may also have been caused by students' lack of understanding of the new learning environment and their subsequent unrealistic estimate of their chances for academic success.

Hypothesis 2. The second structural equation in the model tested the influence of Concentration, Academic Motivation, and Internal Locus of Control on Study Skills, as well as the subsequent impact of Study Skills on Freshman Achievement. In support of our hypothesis, Internal Locus of Control (.31) and Academic Motivation (.38) were found to have a significantly positive influence on Study Skills. Concentration had a significant, indirect influence on Study Skills (.45) when mediated through Self-Efficacy. The impact of Study Skills on Freshman Achievement (.13) was positive but nonsignificant.

Hypothesis 3. The third structural equation in the model examined the influence of Precollege Achievement and Concentration on Freshman Achievement. The strongest influence on Freshman Achievement came from Precollege Achievement (.73) whereas Concentration had a positive but nonsignificant influence (.14) on Freshman Achievement.

[Insert Table 3 About Here]

Four points are noteworthy concerning the structural relations between freshman achievement and cognitive, psychological, facilitative variables. First, of all the variables considered, precollege achievement demonstrated the greatest positive influence on freshman achievement. Second, psychological factors such as academic motivation, internal locus of control, and self-efficacy had a positive influence on freshmen's study skills but their direct impact on freshman achievement was either none-existent or trivial (see table 3). Third, the influence of facilitative variables such as study skills and concentration on freshman achievement was positive but only marginal. Fourth, although self-efficacy of college freshmen was positively influenced by their precollege achievement, it did not help to predict freshman achievement.

Discussion and Conclusions

The present study tested the causal structures between cognitive, psychological, and facilitative factors and freshman academic achievement. The results of the study revealed a non-linear relationship between psychological variables such as academic motivation, locus of control, and self-efficacy on the one hand and freshman academic achievement on the other. In other words, being academically motivated, preferring internal attributions for academic outcomes, and having confidence in one ability to do well in college do not directly result in good academic performance during the freshman year. These results in part lend support to Warehime's (1972) report on negligible correlations between locus of control and freshman grades. The findings from the present study seem to imply that other factors such as adequate academic preparation, adjustment to instructional styles and course requirements in a college environment, and the ability to prioritize study in the midst of the chaotic freshman experience are necessary to help entering students to cope with academic challenges during the freshman year.

In accord with previous research findings, facilitative variables such as concentration and study skills demonstrated a positive yet marginal impact on freshman achievement. While concentration exerted a direct impact on freshman achievement, the influence of study skills was mediated through academic motivation, locus of control, and self-efficacy. These findings reveal the complex nature of the interaction patterns of various factors within an educational environment. While having a positive attitude to study (e.g., being motivated and preferring internal attribution for academic outcomes) and believing in one's ability to do well academically do not warrant good grades, they do promote students to adopt more productive approaches to study which, in turn, lead to better grades.

In support of previous research and our hypothesis, cognitive factors proved to be the best predictors of freshman academic achievement. This is clearly reflected in the strong, positive relationship between precollege achievement variable and freshman achievement. This finding underscores the notion that good academic preparation in high school is crucial to academic success during the freshman year.

Perhaps the most surprising finding of the study came from the negative relationship between self-efficacy and freshman achievement. The negative relationship between the two

variables may have been caused by the fact that college freshmen have an unrealistic estimate of their ability due to lack of understanding of the subject-object relationship in the new learning environment. It may also have occurred because the measure of self-efficacy as used in the present study was global rather than grade-specific, thus had a weak predictive power of the freshman GPA (Ferrari & Parker, 1992).

The strength of the present study lies in its simultaneous consideration of cognitive, psychological, and facilitative variables in the investigation of freshman academic achievement. The use of a structural equation model allows the researchers to determine the causal relations between freshman academic achievement and other relevant variables. The causal ordering of cognitive, psychological, and facilitative variables and freshman academic achievement revealed in the study has implications for both researchers and student-affairs professionals working in higher education.

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Table 1
Standardized Parameter Estimates of the Measurement Model: Target Loading and Error Variance of Measurement Indicators

Indicator	C	AM	ILOC	PA	SE	SS	FA	Θ_δ
C1	**.74**	0*	0*	0*	0*	0*	0*	.45
C2	**.57**	0*	0*	0*	0*	0*	0*	.68
C3	**.59**	0*	0*	0*	0*	0*	0*	.65
AM1	0*	**.77**	0*	0*	0*	0*	0*	.41
AM2	0*	**.59**	0*	0*	0*	0*	0*	.66
ILOC1	0*	0*	**.63**	0*	0*	0*	0*	.61
ILOC2	0*	0*	**.65**	0*	0*	0*	0*	.58
ILOC3	0*	0*	**.54**	0*	0*	0*	0*	.71
HSGPA	0*	0*	0*	**.46**	0*	0*	0*	.78
SAT	0*	0*	0*	**.73**	0*	0*	0*	.47
Math	0*	0*	0*	**.68**	0*	0*	0*	.54
SE1	0*	0*	0*	0*	**.66**	0*	0*	.56
SE2	0*	0*	0*	0*	**.70**	0*	0*	.52
SS1	0*	0*	-.41	0*	0*	**.71**	0*	.51
SS2	0*	0*	0*	0*	0*	**.76**	0*	.42
SS3	0*	0*	0*	0*	0*	**.67**	0*	.55
CGPA1	0*	0*	0*	0*	0*	0*	**.89**	.20
CGPA2	0*	0*	0*	0*	0*	0*	**.93**	.14

Indices of Goodness-of-fit	χ^2 = 192.58	df = 113	p = .0000045	χ^2/df = 1.70
	CFI = .96	ECVI = .87	RMSEA = .045	

Note. C = Concentration; AM = Academic Achievement; ILOC = Internal Locus of Control; PA = Precollege Achievement; SE = Self-Efficacy; SS = Study Skills; FA = Freshman Achievement; Θ_δ = error variance of measurement indicators.

* Fixed values. Numbers in bold print are target loadings.

All parameter estimates are statistically significant at $p < .05$.

Table 2
Test Statistics for the Hypothesized Model

Model	χ^2	df	χ^2/df	CFI	ECVI	RMSEA	$\Delta\chi^2$	Δdf
1. Initial	298.92	125	2.39	.90	1.10	.06	—	—
2. Addition of 4 crossloadings[a]	237.73	121	1.96	.93	.95	.05	61.19	4
3. Addition of 3 covariances[b]	185.18	118	1.57	.96	.82	.04	52.55	3
4. Deletion of 1 nonsignificant path[c]	185.18	119	1.56	.96	.82	.04	0	1

Note. CFI = Comparative Fit Index; ECVI = Expected Cross-Validation Index; RMSEA = Root Mean Square Error of Approximation; $\Delta\chi^2$ = Difference in χ^2; Δdf = Difference in degrees of freedom.

[a]Loading of Self-Efficacy on Study Skills; Loading of Study Skills on Freshman Achievement; Loading of Internal Locus of Control on Concentration; Loading of Internal Locus of Control on Precollege Achievement.

[b]Covariance between Concentration and Precollege Achievement; Covariance between Concentration and Internal Locus of Control; Covariance between SAT and Study Skills.

[c]Concentration–> Study Skills.

Table 3
Total Effects (TE), Direct Effects (DE), and Indirect Effects (IE) of Latent Variables on the Endogenous Latent Variables: Standardized Solution

			KSI1 concentration	KSI2 academic motivation	KSI3 internal locus of control	KSI4 precollege achievement	ETA1	ETA2
Self-Efficacy	ETA1	TE	.72	.00	.00	.17		
		DE	.72	.00	.00	.17		
		IE	.00	.00	.00	.00		
Study Skills	ETA2	TE	.45	.38	.31	.11	.63	
		DE	.00	.38	.31	.00	.63	
		IE	.45	.00	.00	.11	.00	
Freshman Achievement	ETA3	TE	.04	.05	.04	.71	-.15	.13
		DE	.14	.00	.00	.73	-.23	.13
		IE	-.10	.05	.04	-.02	.08	.00

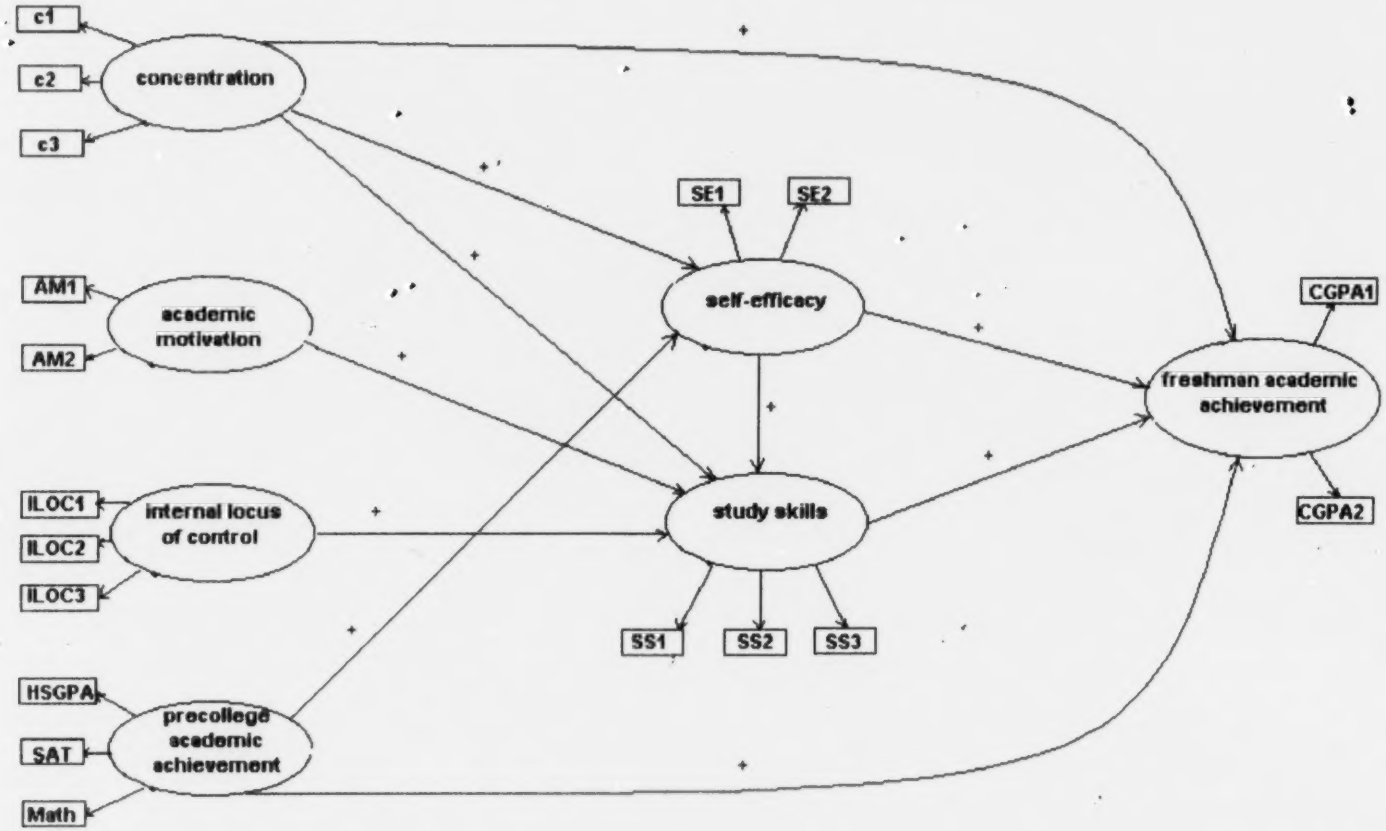

Figure 1: Hypothesized model.

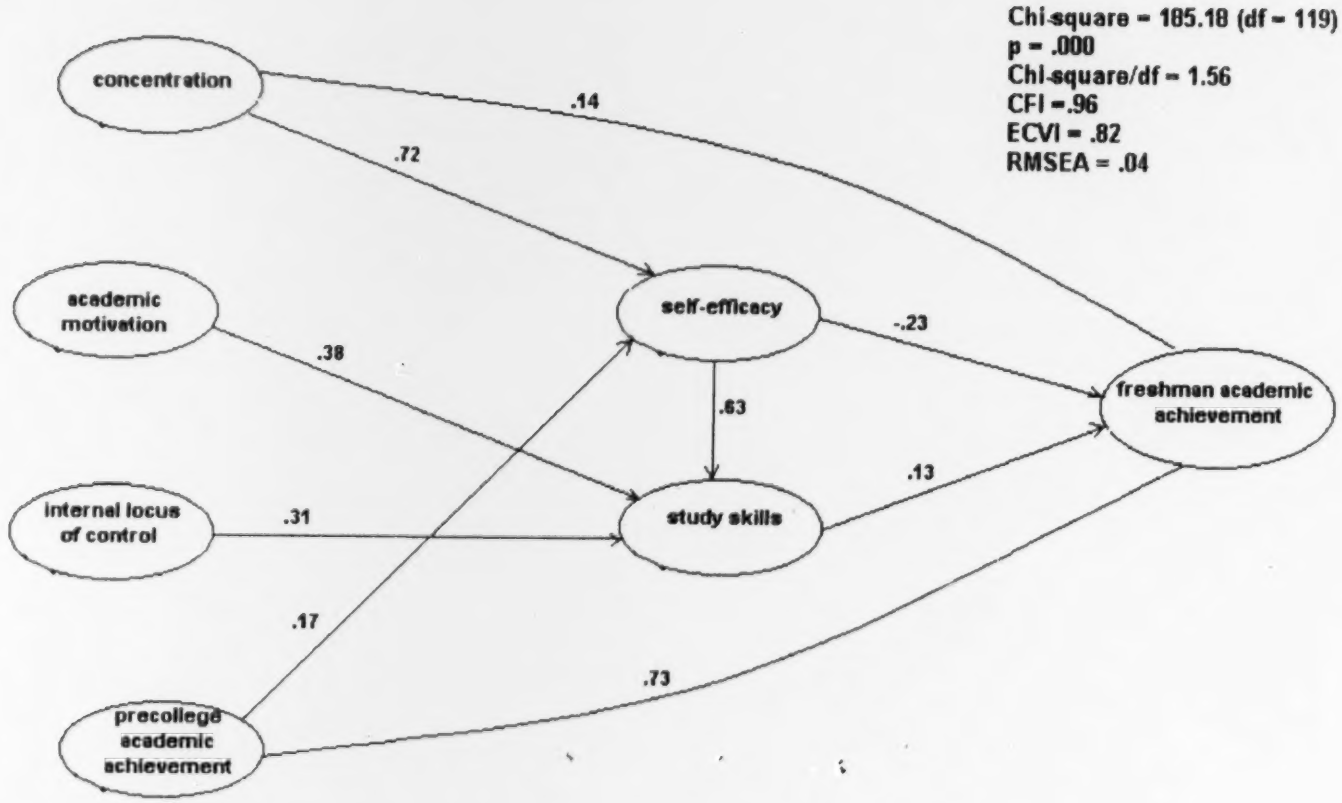

Figure 2: Final model of freshman academic achievement.
Values represent standardized estimates. All path coefficients greater than .17 (absolute value) are significant at .05 level.